



**Testimony**

**Before the Subcommittee on Criminal Justice, Drug  
Policy, and Human Resources  
Committee on Government Reform  
United States House of Representatives**

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**Availability and Effectiveness of Programs  
to Treat Methamphetamine Abuse**

*Statement of*

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Mr. Chairman and Members of the Subcommittee:

Thank you for inviting the National Institute on Drug Abuse (NIDA), a component of the National Institutes of Health (NIH), an agency of the U.S. Department of Health and Human Services (HHS), to participate in this important hearing. As the world's largest supporter of biomedical research on drug abuse and addiction, we have learned much about the behavioral and health effects of methamphetamine (meth) abuse, as well as effective ways to treat those addicted. I am pleased to be here today to present an overview of what the science has taught us about meth—a stimulant drug that can have devastating medical, psychiatric, and social consequences.

NIDA has been conducting research on meth for more than 20 years. During this period, NIDA has been tracking meth abuse and supporting multifaceted research aimed at better understanding how the drug affects the brain and behavior and how we can effectively prevent and treat meth abuse and addiction.

### **Prevalence of Methamphetamine in the United States**

Although several national surveys, including the National Survey on Drug Use and Health (NSDUH), conducted by HHS's Substance Abuse and Mental Health Services Administration (SAMHSA), and NIDA's Monitoring the Future (MTF) survey, do not report overall increases in meth abuse, evidence from emergency departments and treatment programs attest to the growing impact of meth abuse in the country. NIDA's Community Epidemiology Work Group (CEWG), which monitors drug abuse problems in sentinel sites across the Nation, has alerted us to increased meth abuse and associated problems in new areas around the country in recent years. In fact, data from SAMHSA's Treatment Episode Data Set (TEDS) show that in 1993 only 4 states reported high rates of treatment admissions (i.e., >50 per 100,000 population) for meth/amphetamine addiction; by 2003, this number increased to 18, more than a third of the States. The total number of people seeking treatment Nationwide increased almost fourfold within a similar timeframe. Further, meth/amphetamine abuse-related emergency department visits across the country have increased more than 50 percent between 1995 and 2002.

### **What Methamphetamine Does to the Brain and Body**

Methamphetamine is a Schedule II stimulant, which means it has a high abuse potential and is available only by prescription. Only a few clinical indications justify its medical use, such as to treat narcolepsy and attention deficit hyperactivity disorder (ADHD), although it is rarely used for the latter. However, it is the illicit use of meth, usually manufactured in "super labs" or by "home cooks", which is the core of the problem of meth abuse. As a powerful stimulant, meth, even in small doses, can increase wakefulness and physical activity and decrease appetite. Meth comes in many forms and can be snorted, swallowed, injected, or smoked, the preferred method of abuse varying by geographical region and changing over time. In recent years, faster routes of administration (e.g., smoking and injecting) have become more common, amplifying meth's addiction potential and adverse consequences.

Meth acts by affecting many brain structures but mainly those that contain the neurotransmitter dopamine, due to similarities in their chemical signatures. Meth increases the release of dopamine, producing the "rush" and/or "high" associated with its abuse. As the most potent of the stimulant drugs, amphetamines elicit more dopamine release than other drugs—three times

more than cocaine. This extra sense of pleasure is followed by a "crash" that often leads to increased abuse of the drug and eventually to difficulty in feeling any pleasure at all.

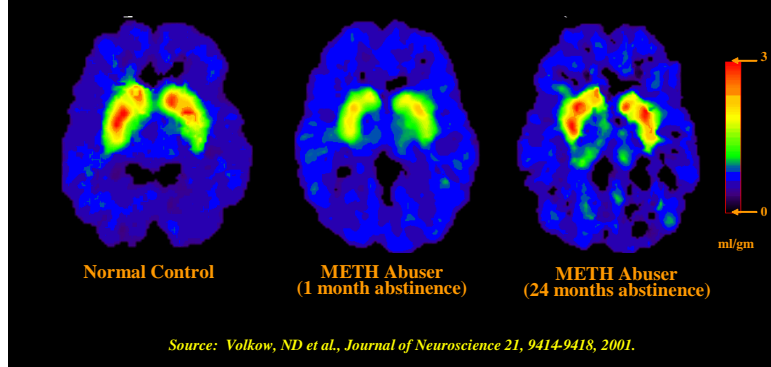
Long-term meth abuse can have many devastating consequences, including addiction. We know from research that addiction is a chronic, relapsing disease, characterized by compulsive drug seeking and use, and accompanied by functional and molecular changes in the brain. NIDA-

supported research has also shown that meth abuse can lead to cardiovascular problems, such as rapid heart rate, irregular heartbeat, increased blood pressure, and irreversible, stroke-producing damage to small blood vessels in the brain. Hyperthermia (elevated body temperature) and convulsions occur with meth overdoses and can result in death. In addition to experiencing deleterious physical health effects, chronic meth abusers exhibit signs of mental distress, including violent behavior, anxiety, depression, confusion, and insomnia. They also can also suffer from psychotic symptoms such as paranoia, auditory hallucinations, and delusions. In animals, meth has been shown to damage nerve terminals in the dopamine- and serotonin-containing regions of the brain. Similarly, studies of meth abusers have demonstrated significant alterations in the activity of the dopamine system, causing slowed movement and impaired verbal learning (Figure 1). One

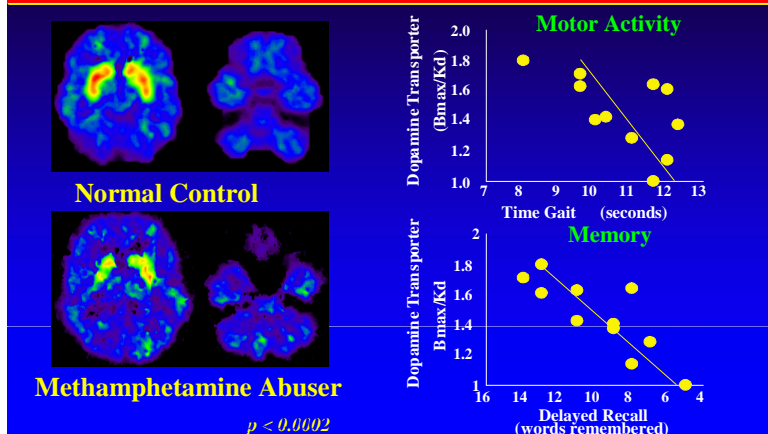
small study also correlated changes in dopamine-mediated function with duration of meth abuse and severity of psychiatric symptoms. Moreover, recent studies of chronic meth abusers have revealed severe structural and functional deficits in brain areas associated with emotion and linked to depression and anxiety, as well as memory. However, dopamine cells do not appear to be permanently damaged in meth abusers, so that with extended abstinence, they

achieve some recovery (Figure 2). A recent neuroimaging study of meth abusers showed partial recovery of brain function in some regions following protracted abstinence, associated with improved performance on motor and verbal memory tests. However, function in other regions did not display recovery even after two years of abstinence, indicating that some meth-induced

**Figure 2. Partial Recovery of Brain Dopamine Transporters in Methamphetamine (METH) Abuser After Protracted Abstinence**



**Figure 1. Dopamine Transporters in Methamphetamine Abusers**



changes are much longer lasting. Additionally, increased risk of cerebrovascular accidents from the abuse of meth can lead to irreversible damage to the brain.

### **Developmental Exposure**

In addition to its known effects in adults, NIDA is very concerned about the effects of meth on the development of children exposed to the drug prenatally. Unfortunately, our knowledge in this area is limited. The few human studies that exist have shown increased rates of premature delivery, placental abruption, fetal growth retardation, and cardiac and brain abnormalities. For example, a recent NIDA-funded study showed that prenatal exposure to methamphetamine resulted in smaller subcortical brain volumes, which were associated with poorer performance on tests of attention and memory conducted at about 7 years of age. However, the human studies so far are inconclusive due to methodological complications, such as small sample size and maternal use of other drugs. For this reason, NIDA recently launched the first large-scale study of the developmental consequences of prenatal meth exposure, which includes seven hospitals in Iowa, Oklahoma, California and Hawaii, states where meth abuse is prevalent, to evaluate developmental outcomes such as cognition, social relationships, motor skills and medical status. Initial results from this study found that 5.2% of women had used meth at some point during their pregnancy, further indicating the need to better understand the developmental outcomes for these children.

Our knowledge about the effects of meth use later in development is also incomplete. Despite the relatively low levels of meth abuse among young people, we are concerned with any meth abuse in this age group. Because the brain continues to develop well into adolescence and even early adulthood, exposure to drugs of abuse during this time may have a significant impact on brain development and later behavior. Additional research will help us understand the effects of meth abuse during childhood and adolescence and whether these effects persist into adulthood.

### **Methamphetamine and Infectious Diseases**

Methamphetamine is inextricably linked with human immunodeficiency virus (HIV), hepatitis C, and other sexually transmitted diseases. Meth use increases the risk of contracting HIV, not only due to the use of contaminated equipment, but also due to increased risky sexual behaviors as well as physiological changes that may favor HIV transmission. Preliminary studies also suggest that meth may affect HIV disease progression. For example, animal studies suggest that meth use may result in a more rapid and increased brain HIV viral load. Moreover, in a study of HIV-positive individuals being treated with highly active anti-retroviral therapy (HAART), current meth users had higher plasma viral loads than those who were not currently using meth, suggesting that HIV-positive meth users on HAART may be at greater risk of developing acquired immune deficiency syndrome (AIDS) than those on HAART that do not use meth. These differences could be due to poor medication adherence or to interactions between meth and HIV medications. Similarly, preliminary studies suggest that interactions between meth and HIV itself may lead to more severe consequences for meth-abusing, HIV-positive patients, including greater neuronal damage and neuropsychological impairment. More research is needed to better understand these interactions.

### **Treatment for Methamphetamine Addiction Works**

Currently, the most effective treatments for meth addiction are behavioral therapies. One particular type, known as the Matrix Model for meth addiction, has demonstrated efficacy in helping people sustain abstinence. Initially developed in the 1980s for treating cocaine addiction, the Matrix Model is a 16-week program of group and individual therapy, and includes elements addressing relapse prevention, behavioral changes, family communication, healthy environments, and other topics relevant to maintaining abstinence. When applied to meth abusers, the Matrix Model has resulted in a sizable percentage of meth-free urine samples at program completion and 6-month follow-up.

Another behavioral treatment, Motivational Incentives for Enhancing Drug Abuse Recovery (MIEDAR), uses an incentive-based approach to help cocaine and meth abusers with abstinence. It was recently tested through NIDA's National Drug Abuse Clinical Trials Network, where participants in the incentive condition were twice as likely to achieve 8 weeks of documented sustained abstinence as participants receiving treatment as usual. MIEDAR is currently being developed for dissemination to community treatment providers through NIDA's collaborations with SAMHSA.

### **New Treatments for Meth Addiction on the Horizon**

**Behavioral Therapies.** Because no single behavioral treatment will be effective for everyone, research into behavioral approaches for treating meth addiction is ongoing. In 2005, NIDA solicited additional research applications for developing, refining, and testing behavioral and behavioral + pharmacological (and/or complementary/alternative) treatments for meth abuse and addiction. We expect that, as with other types of addiction, combining pharmacotherapies with behavioral therapies will yield the most effective treatments.

**Promising Medications.** NIDA-supported studies are developing medications for all aspects of meth abuse. For many people, depression is a complicating factor in recovery. In fact, imaging studies show that during withdrawal, the brains of meth addicts resemble those of depressed patients. Antidepressants may help during these beginning stages of treatment. Bupropion, marketed as Welbutrin<sup>®</sup>, offers promise as an anti-addiction medication for several illicit drugs. Recent study findings reveal that bupropion reduced acute meth-induced subjective effects as well as cue-induced cravings. A recently completed Phase II clinical trial with bupropion has shown it to be significantly effective in reducing meth abuse in low/moderate users. A follow-up trial is planned.

Another clinical trial has focused on topiramate, an anti-epileptic medication already on the market as TOPAMAX<sup>®</sup>. A NIDA-supported Phase I safety interaction study between topiramate and meth has been completed, with no safety concerns. A Phase II outpatient study with topiramate in meth-addicted individuals is underway, in collaboration with OrthoMcNeil Pharmaceuticals. Also, a preliminary study with gamma-vinyl GABA (GVG), a different anti-epileptic medication (approved in Europe but not in the U.S.), marketed as Vigabatrin<sup>®</sup> or Sabril<sup>®</sup>, has shown that half of the treated patients remained drug-free for approximately 6 weeks, despite living in their normal home environments with ready access to drugs. To continue to identify novel anti-addiction medications for meth and other drugs of abuse, in 2006, NIDA requested applications for pilot clinical studies of new compounds whose utility has been documented in preclinical models--so as to establish an adequate foundation for more extensive clinical research.

A new generation of monoclonal antibody-based medications, designed to provide a rapid reversal of meth effects in an emergency room setting and reduce or prevent long-term medical problems, has shown positive results in animal studies. Advances in the development of technology for large-scale production of monoclonal antibodies in plants now makes this approach commercially feasible.

***Combined Approaches.*** Addiction changes the parts of the brain that affect our ability to think, to control impulses, and to understand consequences. Because drug-impaired cognitive functioning, such as diminished verbal memory and learning skills, can predict treatment dropout and lead to continued abuse and relapse, people undergoing addiction treatment also need medications to help them recover this functioning and give behavioral therapies the best chance to work. A “rising star” in this arena is modafinil, a medication used to treat narcolepsy. It appears to improve cognitive functioning in people with schizophrenia and ADHD, and may also complement behavioral counseling for methamphetamine abuse. Meth exceeds other drugs in its disruption of cognition, especially attentional control—or the ability to focus and ignore or inhibit distractions. Because modafinil has shown early efficacy in cocaine treatment and may have positive effects on executive function and impulsivity, it is being tested as a potential treatment in meth addiction.

### **Treating Meth Abuse in the Criminal Justice Population**

Because of the prevalence of drug abuse among the criminal justice population, NIDA, in collaboration with NIH's National Institute on Alcohol Abuse and Alcoholism, SAMHSA, and other federal agencies, established the Criminal Justice Drug Abuse Treatment Research Studies (CJ-DATS), a major research initiative, bringing together researchers, criminal justice professionals, and addiction treatment providers to develop new strategies to help drug-abusing offenders. As part of our efforts to combat meth addiction, CJ-DATS is collecting self-report and biological data on meth abuse and investigating the effectiveness of treatments in criminal justice settings for those who abuse meth. Within CJ-DATS, we are also supporting two research protocols testing comprehensive treatment approaches for juvenile offenders, including those who abuse meth.

### **Relapse Prevention is Key**

Despite the availability of many forms of effective treatment, the problem of relapse remains the primary challenge to achieving sustained recovery for any addiction. Scientific research has given us a better understanding of relapse to drug abuse by revealing the brain mechanisms through which drugs modify mood, memory, perception, and emotional states following chronic exposure. As stated, people trying to recover from drug abuse and addiction are often doing so with altered brains, leading to disordered thinking. Moreover, these brain alterations effectively reorder an addicted person's former hierarchy of needs and desires, substituting an all-consuming drive to seek and abuse drugs, even in the face of dire life consequences. The intense craving for drugs can leave people vulnerable to relapse from various “triggers” (e.g., stress) even long after drug abuse stops.

NIDA-supported research is seeking to identify markers to predict which meth-addicted patients may be more likely to relapse following treatment. For example, a recent study noted that

decreased brain activation during a decision-making task correctly predicted which patients would relapse to meth abuse. These findings may provide an approach for assessing susceptibility to relapse early on during treatment, as well as lead to new treatment approaches targeted at rehabilitating these deficits, thereby increasing a patient's chances for long-term abstinence.

### **Treatment Must Align with the Disease Course of Drug Addiction**

Like other chronic, relapsing diseases, drug addiction requires a continuum of care and can be effectively treated and managed over its course, particularly if treatment modalities align with individual patient needs and address the chronic, complex, and relapse-prone nature of the disease. Addressing the problem of meth addiction requires an approach that encompasses the whole person and addresses the reality of meth-induced brain changes. It is not enough simply to get a person off drugs; rather, addiction treatment must take into account the panoply of social, biological, and behavioral factors that influence addiction and recovery from it. Detoxification or short-term stabilization alone without maintenance or monitoring or a strong aftercare component has shown limited effectiveness. Conversely, customized treatment administered as part of a continuum of care can help people stay off drugs and live a full and meaningful life.

### **Conclusion**

In closing, I would like to say that as someone who has spent almost 25 years studying the effects of psychostimulants on the brain, I am particularly concerned about the methamphetamine problem in this country, especially with its powerful addictive potential and high toxicity, which translates to more addicts and more devastating consequences for individuals and communities. One of NIDA's most important goals is to translate what scientists learn from research to help the public better understand drug abuse and addiction and to develop more effective strategies for their prevention and treatment. NIDA has long supported research on methamphetamine, which is now seeing dividends in the development of effective treatments. It is critical that these treatments become more readily available to those who need them. Thank you for allowing me to share this information with you. I will be happy to answer any questions you may have.